

Module #2 Test

1. The Bohr model created the principal quantum number, n
2. The quantum number l determines the orbital shape
3. b.
4. The electron might emit 3 different possible wavelengths
5. It is atomic absorption spectroscopy
6. electron C is the furthest from the nucleus

7. $\Delta E = (2.18 \times 10^{-18}) Z^2 \left(\left(\frac{1}{n_i} \right)^2 - \left(\frac{1}{n_f} \right)^2 \right)$

$$\Delta E = (2.18 \times 10^{-18}) 1^2 \left(\left(\frac{1}{2} \right)^2 - \left(\frac{1}{4} \right)^2 \right)$$

$$\Delta E = (2.18 \times 10^{-18}) 1 \left(\frac{1}{4} - \frac{1}{16} \right)$$

$$\Delta E = (2.18 \times 10^{-18}) \left(\frac{3}{16} \right) = 4.09 \times 10^{-19} \text{ J}$$

$$\frac{20}{21} = 95\%$$

8. $\text{He}^+ : Z=2$ $E = hf$ $f = \frac{v}{\lambda}$ $h = 6.63 \times 10^{-34} \text{ J/s}$ $v = 3.00 \times 10^8 \text{ m/s}$

$$\Delta E = (2.18 \times 10^{-18}) Z^2 \left(\left(\frac{1}{n_i} \right)^2 - \left(\frac{1}{n_f} \right)^2 \right)$$

$$\Delta E = (2.18 \times 10^{-18}) 2^2 \left(\left(\frac{1}{4} \right)^2 - \left(\frac{1}{2} \right)^2 \right)$$

$$\Delta E = (2.18 \times 10^{-18}) 4 \left(-\frac{3}{16} \right) = -1.64 \times 10^{-18} \text{ J}$$

$$E = 6.63 \times 10^{-34} (f)$$

$$\frac{1.64 \times 10^{-18}}{6.63 \times 10^{-34}} = \frac{6.63 \times 10^{-34} f}{6.63 \times 10^{-34}}$$

$$f = 2.47 \times 10^{15} \text{ Hz}$$

or $2.47 \times 10^{15} \frac{1}{\text{sec}}$

$$f = \frac{v}{\lambda} \quad 2.47 \times 10^{15} \frac{1}{\text{sec}} = \frac{3.00 \times 10^8 \text{ m/sec}}{\lambda}$$

$$\lambda = \frac{3.00 \times 10^8 \text{ m/sec}}{2.47 \times 10^{15} \frac{1}{\text{sec}}} = 1.21 \times 10^{-7} \text{ m}$$

$$9. \Delta E = (2.18 \times 10^{-18} \text{ J}) Z^2 \left(\left(\frac{1}{n_i} \right)^2 - \left(\frac{1}{n_f} \right)^2 \right)$$

$$\frac{-4.09 \times 10^{-18} \text{ J}}{2.18 \times 10^{-18} \text{ J}} = (2.18 \times 10^{-18} \text{ J}) \left(\left(\frac{1}{4} \right)^2 - \left(\frac{1}{n_f} \right)^2 \right)$$

$$= -0.188 = \frac{1}{16} - \left(\frac{1}{n_f} \right)^2$$

$$-\frac{1}{16} - \frac{1}{16}$$

$$\sqrt{+0.250} = \sqrt{\left(\frac{1}{n_f} \right)^2}$$

$$\frac{1}{n_f} = 0.500 \cdot n_f$$

$$\frac{1}{0.500 \cdot 0.500} = 0.500 n_f \rightarrow n_f = 2$$

$$10. \text{Li}^{2+}; 1 \text{ electron} \quad n = ? \quad r = ?$$

$$E = -R_H Z^2 \left(\frac{1}{n} \right)^2$$

$$-4.91 \times 10^{-18} \text{ J} = -2.18 \times 10^{-18} \text{ J} (3^2) \left(\frac{1}{n} \right)^2$$

$$-4.91 \times 10^{-18} \text{ J} = -1.96 \times 10^{-17} \left(\frac{1}{n} \right)^2$$

$$\frac{-1.96 \times 10^{-17}}{-1.96 \times 10^{-17}}$$

$$\sqrt{0.250} = \sqrt{\left(\frac{1}{n} \right)^2}$$

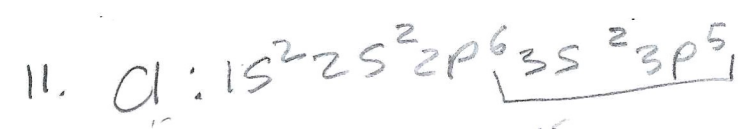
$$\frac{1}{n} = 0.500$$

$$n = 2$$

$$r = 0.529 \text{ \AA} \left(\frac{n^2}{Z} \right)$$

$$r = 0.529 \text{ \AA} \left(\frac{2^2}{3} \right)$$

$$= 0.529 \text{ \AA} \left(\frac{4}{3} \right) = 0.705 \text{ \AA}$$



VE

Electron 1 $3s: n=3, l=0, m_l=0, m_s=\frac{1}{2}$

Electron 2 $3s: n=3, l=0, m_l=0, m_s=-\frac{1}{2}$

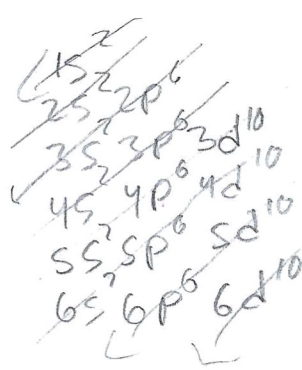
E 3 $3p: n=3, l=1, m_l=-1, m_s=\frac{1}{2}$

E 4 $3p: n=3, l=1, m_l=-1, m_s=-\frac{1}{2}$

E 5 $3p: n=3, l=1, m_l=0, m_s=\frac{1}{2}$

E 6 $3p: n=3, l=1, m_l=0, m_s=-\frac{1}{2}$

E 7 $3p: n=3, l=1, m_l=1, m_s=\frac{1}{2}$



spdf
0 1 2 3

7 electrons + $\frac{2}{3}$

$$\frac{+6}{7}$$

12. a) m_l must be 0 $-l < m_l < l$

b) m_s can only be $\frac{1}{2}$ or $-\frac{1}{2}$

c) when $n=2$, l can only be 0 or 1

O/c when
 $n=2$